WHAT IS CLAIMED IS:

1. A method for measuring voice quality of a communication network, comprising:

providing a reference marker that indicates onset time of a reference voice test signal, and the reference voice test signal;

receiving through the network packets containing a transmitted marker and a transmitted voice test signal through the network;

comparing the transmitted marker with the reference marker, or portions thereof, to ascertain onset time of the transmitted voice test signal in the packets received; and

processing the transmitted voice test signal and the reference voice test signal to measure quality of the network.

2. The method of claim 1, wherein the comparison of the markers includes cross-correlating the markers to obtain a score.

3. The method of claim 2, wherein the comparison of the markers includes comparing the cross-correlation score with a threshold.

4. The method of claim 3, wherein a relative timing offset between the transmitted marker and the reference marker corresponding to a cross-correlation score that exceeds the threshold yields information concerning the onset time of the transmitted voice test signal.

5. The method of claim 2, wherein the transmitted marker is in μ-law format, and the comparison of the markers includes converting the marker from μ-law to linear format.

6. The method of claim 1, wherein said providing provides a reference marker that includes a signal having a frequency that changes continuously with time.

7. The method of claim 6, said comparing and processing being operated at a sampling frequency F, wherein said providing provides a reference marker that has N samples and that is a signal y given by:

$$y = \cos\left(2\pi\left(f_0 + \frac{(f1 - f0)\,t}{T_1}\right)t\right)$$

where $f0$ = Onset frequency;

$f1$ = Offset frequency;

T_1 = (N-1)/F; and

$t = t + 1/F$, and $0 \le t \le T_1$.

8. The method of claim 1, said transmitted marker being divided into portions such that each portion thereof contains information concerning the onset, wherein each of at least some of said received packets contains one of the portions of the transmitted marker, and wherein said comparing compares the portion of the transmitted marker in each of the at least some of said received packets to the reference marker after such packet is received, so that information concerning onset time becomes available prior to receipt of packets containing the entire transmitted marker.

9. The method of claim 1, wherein said providing provides a marker that is not more than 5 seconds in duration.

10. The method of claim 1, further comprising transmitting packets containing the transmitted marker and transmitted voice test signal from a first device to a second device through the network, wherein the receiving and processing are associated with the second device.

11. The method of claim 1, further comprising transmitting packets containing the transmitted marker and transmitted voice test signal from a first device to a second device through the network and transmitting such packets from the second device back to the first device, wherein the receiving and processing are associated with the first device.

12. The method of claim 1, said reference marker divided into portions, said transmitted marker being also divided into portions such that the portions of the transmitted marker are received consecutively, wherein said comparing cross-correlates a current portion of the transmitted marker after it is received and before a next portion is received with each portion of the reference marker, and stores a score of the cross-correlation.

13. The method of claim 12, said comparing further comprising comparing the scores from cross-correlation of the current portion with the different portions of the reference marker, selects a maximum score from such scores and compares the maximum score with a threshold.

14. The method of claim 13, wherein said comparing cross-correlates the current portion with the different portions of the reference marker consecutively, compares the cross-correlation score obtained in each of such cross-correlations with a previously stored score, if any, and replaces the previously stored score, if any, with a current one if it is greater than the previously stored score.

15. A method for measuring voice quality of a communication network, comprising:

providing a reference voice test signal;

receiving through the network packets containing a transmitted voice test signal through the network, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal; and

processing the transmitted voice test signal in the packets received and the reference voice test signal to measure quality of the network, and wherein said processing processes the portion of the transmitted voice test signal in each of the at least some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal.

16. The method of claim 15, said processing including normalizing the portion of the transmitted voice test signal in one of said received packets prior to receipt of at least one packet containing at least another portion of the transmitted voice test signal.

17. The method of claim 16, further comprising:

providing a reference marker that indicates onset time of the reference voice test signal; and

receiving through the network packets containing a transmitted marker;

wherein said processing including computing a normalization factor from the powers of the reference and transmitted markers and wherein said normalizing normalizes by means of the factor.

18. The method of claim 16, wherein said normalizing computes a normalization factor using a weighted average of power of a previously received portion and power of currently received portion of the transmitted voice test signal.

19. The method of claim 15, wherein information concerning quality of the network becomes available after receipt of at least one packet containing at least one portion of the transmitted voice test signal.

20. The method of claim 15, further comprising transmitting packets containing the transmitted voice test signal from a first device to a second device through the network, wherein the receiving and processing are associated with the second device.

21. The method of claim 15, further comprising transmitting packets containing the transmitted voice test signal from a first device to a second device through the network and transmitting such packets from the second device back to the first device, wherein the receiving and processing are associated with the first device.

22. A method for measuring voice quality of a communication network, comprising:

causing a first VOPN device to communicate with a second VOPN device through the network;

transmitting data packets from the first VOPN device to the second VOPN device through the network, said packets containing a voice test signal;

receiving the transmitted packets through the network; and

processing the voice test signal in the transmitted packets received and a reference voice test signal to measure quality of the network.

23. The method of claim 22, wherein the receiving and processing are associated with the second device.

24. The method of claim 22, further comprising transmitting the packets transmitted from the first device and received by the second device back to the first device, wherein the receiving and processing are associated with the first device.

25. The method of claim 22, wherein said transmitting transmits packets containing a marker followed by the voice test signal, said method further comprising comparing the transmitted marker or a portion thereof with at least a portion of a reference marker to identify an onset time of the transmitted voice test signal prior to the processing.

26. The method of claim 22, wherein said processing makes use of the onset time of the transmitted voice test signal.

27. The method of claim 22, wherein said causing is initiated by a network management system.

28. A VOPN device for sending data packets containing voice signals through a communication network, comprising:

a CPU;

a bus carrying voice data; and

a voice quality module in communication with the CPU and the bus, said module comprising a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network and a reference voice test signal to test the quality of the network.

29. The device of claim 28, said processor providing a reference voice test signal and also a reference marker that indicates onset time of the reference voice test signal to the bus for transmission to another VOPN device.

30. The device of claim 29, said device transmitting packets containing the reference marker and the reference voice test signal to another device through the network.

31. The device of claim 30, said processor compares the reference marker transmitted to and returned by another device and the reference marker and processes the reference voice test signal transmitted to and returned by another device with the reference voice test signal to measure the quality of the network.

32. The device of claim 28, wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network.

33 The device of claim 32, wherein the comparison of the markers includes cross-correlating the markers to obtain a cross-correlation score and comparing the cross-correlation score with a threshold.

34. The device of claim 33, wherein a relative timing offset between onset times of the transmitted and reference markers corresponding to a cross-correlation score

that exceeds the threshold yields information concerning the onset time of the transmitted voice test signal.

35. The device of claim 32, wherein the transmitted marker is in μ-law format, and the comparison of the markers includes converting the transmitted marker from μ-law to linear format.

36. The device of claim 32, said transmitted marker being divided into portions such that each portion thereof contains information concerning the onset time of the transmitted voice test signal, wherein each of at least some of said received packets contains one of the portions of the transmitted marker, and wherein said processor compares the portion of the transmitted marker in each of the at least some of said received packets to the reference marker after such packet is received, so that information concerning onset time becomes available prior to receipt of packets containing the entire transmitted marker.

37. The device of claim 32, said processor comparing a marker transmitted by another device with the reference marker and processes the reference voice test signal and a voice test signal transmitted from another device to measure the quality of the network.

38. The device of claim 32, said reference marker divided into portions, said transmitted marker being also divided into portions such that the portions of the transmitted marker are received consecutively, wherein said processor cross-correlates a current portion of the transmitted marker after it is received and before a next portion is received with each portion of the reference marker, and stores a score of the cross-correlation.

39. The device of claim 38, said processor comparing the scores from cross-correlation of the current portion with the different portions of the reference marker, selects a maximum score from such scores and compares the maximum score with a threshold.

40. The device of claim 39, wherein said processor cross-correlates the current portion with the different portions of the reference marker consecutively, compares the cross-correlation score obtained in each of such cross-correlations with a previously stored score, if any, and replaces the previously stored score, if any, with a current one if it is greater than the previously stored score.

41. The device of claim 32, said device receiving through the network packets containing the transmitted voice test signal, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal, and wherein said processor processes the portion of the transmitted voice test signal in each of the at least some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal.

42. The device of claim 41, said processor normalizing the portion of the transmitted voice test signal in one of said received packets prior to receipt of at least one packet containing at least another portion of the transmitted voice test signal.

43. The device of claim 42, the processor providing a reference marker indicating onset time of the reference voice test signal, the device receiving through the network packets containing a transmitted marker, wherein said processor computes a normalization factor from the powers of the reference and transmitted markers and wherein said normalizing normalizes by means of the factor.

44. The device of claim 42, wherein said processor computes a normalization factor using a weighted average of power of a previously received portion and power of currently received portion of the transmitted voice test signal.

45. The device of claim 41, wherein information concerning quality of the network becomes available after receipt of at least one packet containing at least one portion of the transmitted voice test signal.

46. The device of claim 28, wherein said processor provides a reference marker that includes a signal having a frequency that changes continuously with time.

47. The device of claim 46, said processor operating at a sampling frequency F, wherein said processor provides a reference marker that has N samples and that is a signal y given by:

$$y = \cos\left(2\pi\left(f_0 + \frac{(f1 - f0)\,t}{T_1}\right)t\right)$$

where $f0$ = Onset frequency;

$f1$ = Offset frequency;

T_1 = (N-1)/F; and

$t = t + 1/F$, and $0 \le t \le T_1$.

48. The device of claim 28, wherein said processor provides a reference marker that is not more than 5 seconds in duration.

49. The device of claim 28, wherein said CPU and bus are contained in a container with connectors connected to the module.

50. The device of claim 28, wherein said module includes a memory storing a reference voice test signal and/or a reference marker signal.

51. The device of claim 28, wherein said memory includes a flash memory.

52. The device of claim 28, wherein said processor includes a digital signal processor.

53. The device of claim 28, wherein said bus includes a TDMA bus.

54. A voice quality module for use with a VOPN device for testing quality of a communication network through which data packets containing voice signals are sent to and from the device, said device comprising a CPU and a bus carrying voice data; said module comprising:

a processor that provides a reference voice test signal to the bus for transmission to another VOPN device, or that processes a transmitted voice test signal received by the device through the network with a reference voice test signal to test the quality of the network.

55. The module of claim 54, said processor providing a reference voice test signal and also a reference marker that indicates onset time of the reference voice test signal to the bus for transmission to another VOPN device.

56. The module of claim 55, said device transmitting packets containing the reference marker and the reference voice test signal to another device through the network, and wherein said processor compares the reference marker transmitted to and returned by another device with the reference marker and processes the reference voice test signal transmitted to and returned by another device with the reference voice test signal to measure the quality of the network.

57. The module of claim 54, wherein said processor processes the reference and transmitted voice test signals, and compares a transmitted marker received by the device through the network with a reference marker to identify a timing offset between onset times of the reference and transmitted voice test signals and processes the two voice test signals to measure the quality of the network.

58 The module of claim 57, wherein the comparison of the markers includes cross-correlating the markers to obtain a cross-correlation score and comparing the cross-correlation score with a threshold.

59. The module of claim 58, wherein a relative timing offset between onset times of the transmitted and reference markers corresponding to a cross-correlation score that exceeds the threshold yields information concerning the onset time of the transmitted voice test signal.

60. The module of claim 57, wherein the transmitted marker is in μ-law format, and the comparison of the markers includes converting the transmitted marker from μ-law to linear format.

61. The module of claim 57, said transmitted marker being divided into portions such that each portion thereof contains information concerning the onset time of the transmitted voice test signal, wherein each of at least some of said received packets contains one of the portions of the transmitted marker, and wherein said processor compares the portion of the transmitted marker in each of the at least some of said received packets to the reference marker after such packet is received, so that information concerning onset time becomes available prior to receipt of packets containing the entire transmitted marker.

62. The module of claim 57, said processor comparing a marker transmitted by another device with the reference marker and processes the reference voice test signal and a voice test signal transmitted from another device to measure the quality of the network.

63. The module of claim 57, said reference marker divided into portions, said transmitted marker being also divided into portions such that the portions of the transmitted marker are received consecutively, wherein said processor cross-correlates a current portion of the transmitted marker after it is received and before a next portion is

received with each portion of the reference marker, and stores a score of the cross-correlation.

64. The module of claim 63, said processor comparing the scores from cross-correlation of the current portion with the different portions of the reference marker, selects a maximum score from such scores and compares the maximum score with a threshold.

65. The module of claim 64, wherein said processor cross-correlates the current portion with the different portions of the reference marker consecutively, compares the cross-correlation score obtained in each of such cross-correlations with a previously stored score, if any, and replaces the previously stored score, if any, with a current one if it is greater than the previously stored score.

66. The module of claim 57, said device receiving through the network packets containing the transmitted voice test signal, said transmitted voice test signal being divided into portions, wherein each of at least some of said received packets contains one of the portions of the transmitted voice test signal, and wherein said processor processes the portion of the transmitted voice test signal in each of the at least some of said received packets and the reference voice test signal after such packet is received, so that information concerning quality of the network becomes available after receipt of packet(s) containing said portion(s) and before receipt of packets containing all of the portions of the transmitted voice test signal.

67. The module of claim 66, said processor normalizing the portion of the transmitted voice test signal in one of said received packets prior to receipt of at least one packet containing at least another portion of the transmitted voice test signal.

68. The module of claim 67, the processor providing a reference marker indicating onset time of the reference voice test signal, the device receiving through the network packets containing a transmitted marker, wherein said processor computes a

normalization factor from the powers of the reference and transmitted markers and wherein said normalizing normalizes by means of the factor.

69. The module of claim 67, wherein said processor computes a normalization factor using a weighted average of power of a previously received portion and power of currently received portion of the transmitted voice test signal.

70. The module of claim 66, wherein information concerning quality of the network becomes available after receipt of at least one packet containing at least one portion of the transmitted voice test signal.

71. The module of claim 54, wherein said processor provides a reference marker that includes a signal having a frequency that changes continuously with time.

72. The module of claim 71, said processor operating at a sampling frequency F, wherein said processor provides a reference marker that has N samples and that is a signal y given by:

$$y = \cos\left(2\pi\left(f_0 + \frac{(f1 - f0)\,t}{T_1}\right)t\right)$$

where $f0$ = Onset frequency;

$f1$ = Offset frequency;

T_1 = (N-1)/F; and

$t = t + 1/F$, and $0 \le t \le T_1$.

73. The module of claim 54, wherein said processor provides a reference marker that is not more than 5 seconds in duration.

74. The module of claim 54, wherein said module includes a memory storing a reference voice test signal and/or a reference marker signal.

75. The module of claim 54, wherein said memory includes a flash memory.

76. The module of claim 54, wherein said processor includes a digital signal processor.

77. A method for measuring voice quality of a communication network, comprising:

providing a reference marker that indicates onset time of a reference voice test signal, and the reference voice test signal; and

transmitting to a device through the network packets containing the reference marker and a reference voice test signal through the network.

78. A method for measuring voice quality of a communication network, comprising:

providing a reference marker that indicates onset time of a reference voice test signal, and the reference voice test signal; and

receiving through the network packets containing a transmitted marker and a transmitted voice test signal through the network.

79. The method of claim 78, further comprising comparing the transmitted marker with the reference marker, or portions thereof, to ascertain onset time of the transmitted voice test signal in the packets received.

80. The method of claim 79, further comprising processing the transmitted voice test signal and the reference voice test signal to measure quality of the network.